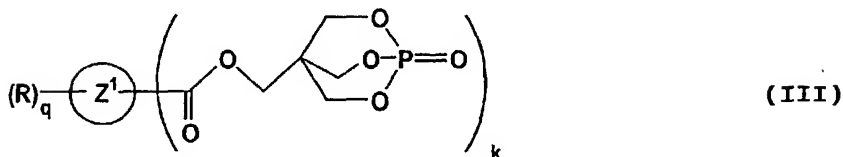
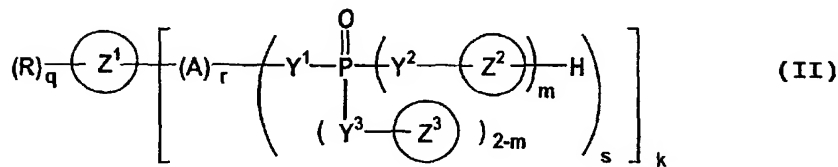
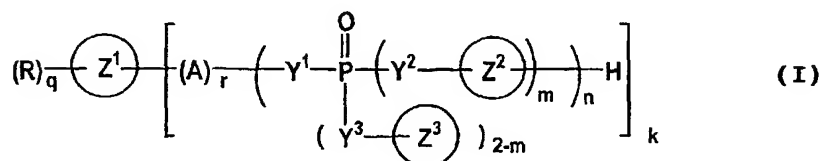


CLAIMS

1. A phosphorus-containing compound represented by the following formula (I), (II) or (III):

5



wherein Z^1 , Z^2 and Z^3 are the same or different, each representing a cycloalkane ring, a cycloalkene ring, a polycyclic aliphatic hydrocarbon ring or an aromatic hydrocarbon ring, in which these rings may have a substituent; R represents a halogen atom, a hydroxyl group, a carboxyl group, a halocarboxyl group, an alkyl group, an alkoxy group, an alkenyl group or an aryl group; A represents a polyvalent group corresponding to an alkane;

10

Y^1 , Y^2 and Y^3 are the same or different, each representing -O-, -S- or $-NR^1-$

wherein R^1 represents a hydrogen atom or an alkyl group;

5 k represents an integer of 1 to 6; m represents an integer of 0 to 2; n represents an integer of not less than 1; q represents an integer of 0 to 5; r represents 0 or 1; s represents an integer of 1 to 4; and

provided that when Z^1 is a cyclohexane ring, q is 0, and k is 1, factor r for A is 1; when Z^1 is a cyclohexane ring, q is 0, and k is 2 to 6, at least one of plural factors r for A is 1; and when Z^1 is a benzene ring and k is 1, the factor r for A is 1; when Z^1 is a benzene ring and k is 2 to 6, at least one of plural factors r for A is 1.

10 2. A phosphorus-containing compound according to claim 1, wherein the rings Z^1 , Z^2 and Z^3 each is a dicyclic or tricyclic aliphatic hydrocarbon ring.

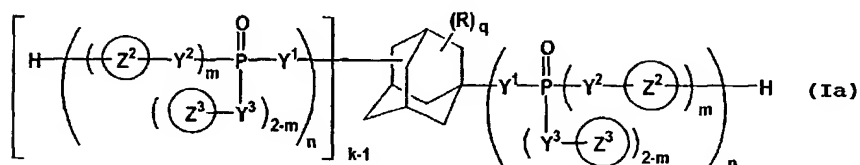
15 3. A phosphorus-containing compound according to claim 1, wherein the ring Z^1 is a norbornane ring, an adamantane ring, a tricyclo[5.2.1.0^{2,6}]decane ring, or a benzene ring, and the rings Z^2 and Z^3 each is an adamantane ring or a benzene ring.

20 4. A phosphorus-containing compound according to claim 1, wherein R is a halogen atom, a hydroxyl group, a C_{1-4} alkyl group, or a C_{1-4} alkoxy group in the formula (I).

25 5. A phosphorus-containing compound according to claim 1, wherein each Y^1 , Y^2 and Y^3 represents -O-.

6. A phosphorus-containing compound according to claim 1, wherein k is an integer of 1 or 2, n is 1, and q is an integer of 0 to 2.

7. A phosphorus-containing compound according to claim 1, wherein a phosphorus-containing compound of the formula (I) is represented by the following formula (Ia):



wherein the Z^2 , Z^3 , R, Y^1 , Y^2 , Y^3 , k, m, n and q have the same meanings as defined above.

8. A phosphorus-containing compound according to claim 7, wherein, in the formula (Ia), Z^2 and Z^3 are the same or different, each representing a benzene ring or an adamantane ring in which these rings may have a substituent; R is a halogen atom, a hydroxyl group, a C_{1-6} alkyl group, or a C_{1-6} alkoxy group; Y^1 , Y^2 and Y^3 each is -O- or -NR¹- (wherein R¹ represents a hydrogen atom or a C_{1-4} alkyl group)); k is an integer of 2 to 4; n is an integer of 1 to 3; and q is an integer of 0 to 4.

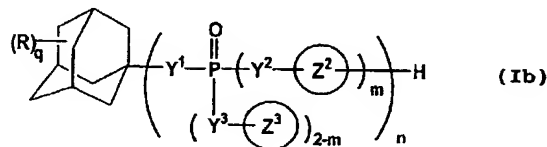
9. A phosphorus-containing compound according to claim 7, wherein, in the formula (Ia), Z^2 and Z^3 are the same or different, each representing a benzene ring which may have a substituent; R is a C_{1-4} alkyl group; n is 1; and

q is an integer of 0 to 2.

10. A phosphorus-containing compound according to claim 7, wherein a compound represented by the formula (Ia) is an adamantylbis, tris or tetrakis-(diC₆₋₁₀aryl phosphate) or an adamantylbis, tris or tetrakis(diC₆₋₁₀aryl phosphoramidate).

11. A phosphorus-containing compound according to claim 7, wherein a compound represented by the formula (Ia) is adamantylbis(diphenylphosphate), dimethyladamantyl bis(diphenylphosphate), or adamantyltris(diphenyl phosphate).

12. A phosphorus-containing compound according to claim 1, wherein a compound of the formula (I) is represented by the following formula (Ib):



wherein the Z², Z³, R, Y¹, Y², Y³, m, n and q have the same meanings as defined above.

13. A phosphorus-containing compound according to claim 12, wherein, in the formula (Ib), Z² and Z³ are the same or different, each representing a benzene ring or an adamantane ring in which these rings may have a substituent; R is a halogen atom, a hydroxyl group, a C₁₋₆alkyl group, or a C₁₋₆alkoxy group; Y¹, Y² and Y³ are the same or different,

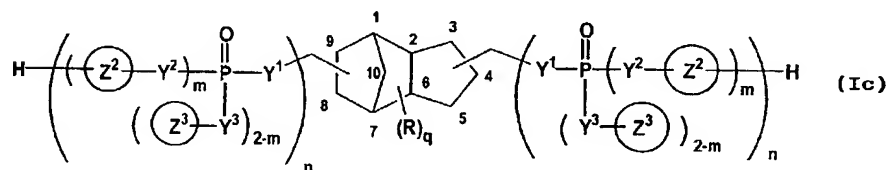
each representing -O- or -NR¹- wherein R¹ represents a hydrogen atom or a C₁₋₄alkyl group; and q is an integer of 0 to 4.

14. A phosphorus-containing compound according to claim 12, wherein, in the formula (Ib), R is a hydroxyl group, a C₁₋₄alkyl group, or a C₁₋₄alkoxy group, and q is an integer of 0 to 2.

15. A phosphorus-containing compound according to claim 12, wherein a compound represented by the formula (Ib) is an adamantyldiC₆₋₁₀arylphosphate or a diadamantyl C₆₋₁₀arylphosphate.

16. A phosphorus-containing compound according to claim 12, wherein a compound represented by the formula (Ib) is adamantyldiphenylphosphate, dimethyladamantyl diphenylphosphate, or bis(adamantyl)phenylphosphate.

17. A phosphorus-containing compound according to claim 1, wherein a compound of the formula (I) is represented by the following formula (Ic):



20

wherein the Z², Z³, Y¹, Y², Y³, m, n and q have the same meanings as defined above.

18. A phosphorus-containing compound according to

claim 17, wherein, in the formula (Ic), Z^2 and Z^3 each is a benzene ring which may have a substituent; R is a halogen atom, a hydroxyl group, a C_{1-6} alkyl group, or a C_{1-6} alkoxy group; and Y^1 , Y^2 and Y^3 are -O-.

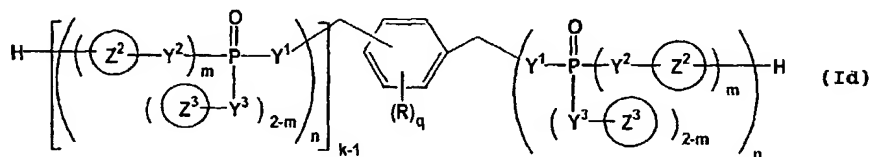
5 19. A phosphorus-containing compound according to claim 17, wherein a compound represented by the formula (Ic) is bis[(di C_{6-10} arylphosphoroxy)methyl]tricyclo[5.2.1.0^{2,6}]decane.

10 20. A phosphorus-containing compound according to claim 17, wherein a compound represented by the formula (Ic) is bis[(diphenylphosphoroxy)methyl]tricyclo[5.2.1.0^{2,6}]decane.

15 21. A phosphorus-containing compound according to claim 17, wherein a compound represented by the formula (Ic) is (4R,8S)-bis(diphenylphosphoroxymethyl)-(1R,2S,6R,7R)-tricyclo[5.2.1.0^{2,6}]decane.

22. A phosphorus-containing compound according to claim 1, wherein a compound of the formula (I) is represented by the following formula (Id):

20



wherein the Z^2 , Z^3 , R, Y^1 , Y^2 , Y^3 , m, n and q have the same meanings as defined above.

23. A phosphorus-containing compound according to

24. A phosphorus-containing compound according to
5 claim 22, wherein a compound represented by the formula
(Id) is xylyleneglycolbis(diphenylphosphate).

- 10



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26. A phosphorus-containing compound according to claim 25, wherein, in the formula (Ie) or (IIa), Z^2 and Z^3 each is a benzene ring which may have a substituent; R is

a halogen atom, a hydroxyl group, a C₁₋₆alkyl group which may have a substituent, a C₁₋₆alkoxy group which may have a substituent, or an alkenyl group which may have a substituent; and Y¹, Y² and Y³ are -O-.

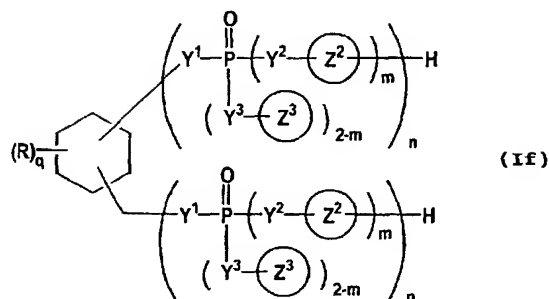
5 27. A phosphorus-containing compound according to claim 25, wherein, in the formula (Ie), n is 1; q is an integer of 0 to 2; r is 1; and s is an integer of 1 to 2.

28. A phosphorus-containing compound according to claim 25, wherein a compound represented by the formula
10 (Ie) or (IIa) is bis(diphenylphosphoroxo)norbornane;
bis(diphenylphosphoroxoC₁₋₄alkyl)norbornane;
bis(diphenylphosphoroxo)-4-C₂₋₄alkenylcyclohexane;
(diphenylphosphoroxoC₁₋₄alkyl)cyclohexene; mono, di or
tri-C₁₋₄alkyl(diphenylphosphoroxoC₁₋₄alkyl)cyclohexyl
15 phosphate; or bis(diphenylphosphoroxo)-[bis(diphenyl
phosphoroxo)C₁₋₄alkyl]cyclohexane.

29. A phosphorus-containing compound according to claim 25, wherein a compound represented by the formula (Ie) or (IIa) is 2,3-bis(diphenylphosphoroxo)norbornane,
20 2,5-bis(diphenylphosphoroxomethyl)norbornane, 1,2-bis(diphenylphosphoroxo)-4-vinylcyclohexane, 1-diphenylphosphoroxomethyl-3-cyclohexene, 3,3,-dimethyl-5-(diphenylphosphoroxomethyl)cyclohexyl phosphate, or
1,2-bis(diphenylphosphoroxo)-4-[1',2'-bis(diphenyl
25 phosphoroxo)ethyl]cyclohexane.

30. A phosphorus-containing compound according to claim 25, wherein a compound of the formula (Ie) is

represented by the following formula (If):

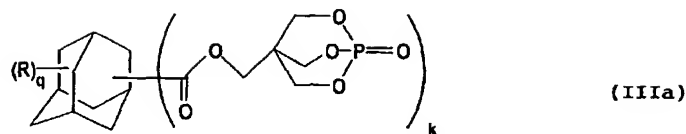


wherein Z^2 , Z^3 , R , Y^1 , Y^2 , Y^3 , m , n and q have the same meanings as defined above.

31. A phosphorus-containing compound according to claim 30, wherein, in the formula (If), Z^2 and Z^3 are the same or different, each representing a benzene ring; R is a halogen atom, a hydroxyl group, a C_{1-6} alkyl group, or a C_{1-6} alkoxy group; and Y^1 , Y^2 and Y^3 are the same or different, each representing $-O-$ or $-NR^1-$.

32. A phosphorus-containing compound according to claim 30, wherein a compound represented by the formula (If) is 1-diphenylphosphoroxy-3-diphenylphosphoroxy methylcyclohexane or 3,3,-dimethyl-5-(diphenyl phosphoroxymethyl)cyclohexylphosphate.

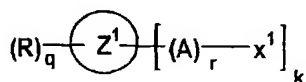
33. A phosphorus-containing compound according to claim 1, wherein a compound of the formula (III) is represented by the following formula (IIIa):



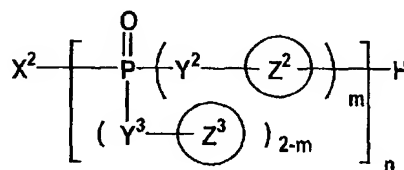
wherein R, q and k have the same meanings as defined above.

5 34. A phosphorus-containing compound according to claim 33, wherein, in the formula (IIIa), R is a carboxyl group, a halocarboxyl group, or a C₁₋₄alkyl group.

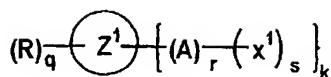
35. A process for producing a phosphorus-containing compound represented by the formula (I), (II) or (III) recited in claim 1, which comprises reacting a compound represented by the following formula (I-1), (II-1) or (III-1) with a compound represented by the following formula (I-2), (II-2) or (III-2):



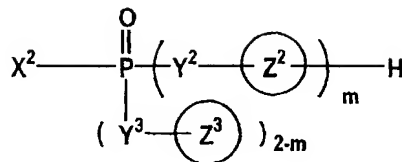
(I-1)



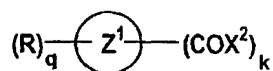
(I-2)



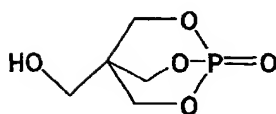
(II-1)



(II-2)



(III-1)



(III-2)

wherein X^1 represents a hydroxyl group, a thiol group, an amino group, or a substituted amino group; X^2 represents a halogen atom, a hydroxyl group, or an alkoxy group; and the Z^1 , Z^2 , R , Y^1 , Y^2 , Y^3 , k , m , q , r and s have the same meanings as defined above.

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